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Taxonomy of *Dolerus subfasciatus* auct. and *D. subfasciatus* F. Smith with notes on the sawfly subgenus *Equidolerus* (Hymenoptera, Tenthredinidae)

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Abstract

Dolerus (*Equidolerus*) *subfasciatus* F. Smith 1874 is a valid species. *Dolerus subfasciatus* auct. is shown to include three distinct species: the Nearctic *D.* (*Equidolerus.*) *neoaprilis* MacGillivray, 1908, **spec**. **rev**. and two Palaearctic species, *D.* (*E.*) *pseudoanticus* Malaise, 1931, **spec**. **rev**. and *D.* (*E.*) *rhodogaster* Zhelochovtsev, 1935, **stat**. **nov**. Distribution records and imaginal diagnostic characters of the species are provided, and the male of *D.* (*E.*) *subfasciatus* is described. Lectotypes are designated for *Dolerus picinus* Marlatt, 1898, *D. picinus rhodogaster* Zhelochovtsev, 1935, *D. pseudoanticus* Malaise, 1931, and *D. yokohamensis* Rohwer, 1925. *Dolerus lucidus* Freymuth, 1870 and *D. purus* Jakowlew, 1891 are associated with the subgenus *Equidolerus* and *D. glabratus* Wei, 2002 is transferred from *Equidolerus* to *Dolerus* s. str.

Kew words: Sawflies, lectotype, nomenclature

Introduction

Comparative phylogeographic studies of the insect taxa which currently occur in widely separated territories, such as western North America and eastern Eurasia, but likely had ancestors with continuous distribution ranges, can help to shed light on biogeographical patterns and evolutionary processes, especially if complemented by DNA sequence analyses. However, such studies can be impeded by numerous taxonomic and nomenclatorial problems on the species level, particularly in diverse but taxonomically insufficiently studied groups like Tenthredinidae.

One taxonomic problem concerns a heterogeneous species assemblage commonly referred to as *Dolerus subfasciatus* F. Smith, 1874, which has been treated mostly as one Holarctic species, but includes at least four distinct species according to our study. *Dolerus* (*E.*) *subfasciatus* F. Smith, 1874 is a valid eastern Palearctic species. *Dolerus neoaprilis* MacGillivray, 1908 (= *D. subfasciatus* auct. non F. Smith), *D. pseudoanticus* Malaise, 1931, and *D. rhodogaster* Zhelochovtsev, 1935, which had been considered either as subspecies or colour forms of *D. subfasciatus*, are all treated here as valid species belonging to the subgenus *Equidolerus* Taeger & Blank, 1996. We present adult diagnostic characters of each, give their distributions, and designate lectotypes where necessary.

Materials and methods

Figure 1 was taken with a Zeiss Axioskop and a Canon EOS450D camera using the image stacking software Helicon Focus v. 5.2. Figures 2 and 4A were acquired through an EntoVision micro-imaging system. This system included a Leica M16 or Leica DRMB compound microscope attached to a JVC KY-75U 3-CCD digital video camera or a GT-Vision Lw11057C digital camera. The program Cartograph 5.6.0 was used to merge image series

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(typically representing 30 focal planes) into a single in-focus image. Lighting was achieved using techniques summarized in Buffington et al. (2005), Kerr et al. (2009), and Buffington & Gates (2009). Figures 4B, 8, 12, 14–16 were acquired using a Leica DM3000 microscope and Leica DFC290 (HD) digital camera with LAS software (v4). The images in Figures 5 and 6 were taken with an Olympus BX51 compound microscope and a camera DP71 attached, those in Figures 7, 9–11, 13, 18–20 using an Olympus SZ61 stereomicroscope with a Leica D-LUX 3 camera mounted to one of its ocular tubes (only camera was used for imaging the labels in Figs 18–20). The figures were prepared in Adobe Photoshop© CS3 by MH.

CombineZP (by Alan Hadley; http://www.hadleyweb.pwp.blueyonder.co.uk/index.htm) was used for extended focal imaging (Figs 4B, 5–6, 8, 12, 14–16) and Fiji/ImageJ version 1.46a (by Wayne Rasband; http://rsb.info.nih.gov/ij/) for creating image mosaics using the plugin MosaicJ (Thévenaz & Unser 2007), and for preparing the image overlays of ovipositors / lancets (Figs 3–4) and penis valves (Fig. 17) to compare the similar structures by pairs using landmarks (one image was transformed according to landmark correspondences with another image).

Morphological terminology follows Goulet (1986) and Viitasaari (2002).

The institutional collections consulted or referred to are the following:

BMNH	The Natural History Museum [formerly British Museum (Natural History)], London, United Kingdom (G. Broad, S. Ryder, N. Dale-Skey Papilloud, N. Springate);
CSCS	Central South University of Forestry and Technology, Changsha, China (M.-C. Wei);
INHS	Illinois Natural History Survey, Champaign, USA (P. Tinerella, D. Dmitriev);
MZAT	Museum Zoologicum Åbo Academi, Turku, Finland (A. Teräs);
NHRS	Naturhistoriska Riksmuseet, Sektionen för entomologi, Stockholm, Sweden (H. Vårdal);
NSMT	National Museum of Nature and Science, Tsukuba, Japan (A. Shinohara).;
SDEI	Senckenberg Deutsches Entomologisches Institut, Müncheberg, Germany (A. Taeger, S.M. Blank, A.D. Liston);
USNM	National Museum of Natural History, Smithsonian Institution, Washington DC, USA (D.R. Smith);
ZIN	Zoological Institute of the Russian Academy of Sciences, St. Petersburg, Russia (S.A. Belokobylskij, A.G. Zinovjev);
ZMH	Zoological Museum, Division of Entomology, Helsinki, Finland [including the coll. of former DABUH = Department of Applied Biology, University of Helsinki, Finland] (O. Biström, P. Malinen);
ZMHB	Museum für Naturkunde der Humboldt-Universität, Berlin, Germany (F. Koch);
ZMUM	Moscow State University, Moscow, Russia (A.V. Antropov).

Results and discussion

Morphological study of numerous specimens from North America and the Palaearctic Region (mainly from Japan and Russia), most of which were previously identified as *D. subfasciatus*, and the type specimens of *D. neoaprilis*, *D. picinus*, *D. picinus rhodogaster*, *D. pseudoanticus*, and *D. subfasciatus* revealed that four distinct species are involved in what has usually been considered one polytypic Holarctic species, *D. subfasciatus* F. Smith.

Dolerus neoaprilis has been treated as a different subspecies or only a colour variation (with a dominantly red abdomen) of *D. subfasciatus* (abdomen almost completely black). However, our study demonstrates that two distinct allopatric species are involved: *D.* (*E.*) *neoaprilis* is strictly Nearctic, and *D.* (*E.*) *subfasciatus* is strictly eastern Palaearctic.

Taxonomic problems concerning *D. subfasciatus* have likely persisted because (1) the male of Palaearctic *D. subfasciatus* (= *D. picinus* Marlatt, 1898) was overlooked or misidentified by most authors outside Japan, and the male of the Nearctic *D. neoaprilis* was readily accepted as that of *D. subfasciatus*, making the synonymy of the two taxa by Goulet (1986) quite logical and (2) black males of *D. japonicus* Kirby were misinterpreted as those of *D. picinus* by Marlatt (1898) or often misidentified as *D. subfasciatus* by later authors (occasionally even by Japanese authors, who knew the male of *D. subfasciatus*). Study of the lectotype female of *D. neoaprilis* showed that it corresponds with a Nearctic species, *D. subfasciatus* auct. which was usually misinterpreted as a colour form of *D. subfasciatus* F. Smith.

The existing syntype series of *D. picinus* was found to be heterogeneous, consisting of *D. subfasciatus* female and a male of *D. japonicus*. Thus, the lectotype of *D. picinus* Marlatt, 1898 is selected (see the species record for *D. subfasciatus*). We also found that the male syntype of *D.* (*Poodolerus*) *yokohamensis* Rohwer, 1925 is a misidentified male of *D. subfasciatus* by Rohwer, and we designate a lectotype for that species.

A study of the morphological variation in about 80 *D. subfasciatus* females collected from Japan and identified mostly as *D. subfasciatus* (sometimes as *D. picinus* by some Japanese authors) shows clearly that the lectotype females of *D. picinus* and *D. subfasciatus* (both from Japan) are conspecific (see digital overlay of their lancet images using 9 landmarks in Fig. 3). Therefore, we support the synonymy of *D. picinus* with *D. subfasciatus*, first suggested by Takeuchi (1952) and probably independently later proposed by Benson (1956). Some Japanese authors (e.g., Abe & Togashi 1989) treated *D. subfasciatus* and *D. picinus* as separate species, even after publication of the synonymy by Benson (1956), probably because they overlooked Benson's paper (not because of mistaking the *D. japonicus* males as *D. picinus*).

Details of the imaginal morphology (Table 1) of the types of *D. pseudoanticus* and of *D. picinus rhodogaster* suggest that the two are not synonymous with *D. subfasciatus*, as proposed by Benson (1956, 1962), and that they are distinct from *D. neoaprilis* and also from each other. However, separation of the *D. neoaprilis* and *D. pseudoanticus* males remains problematic because only a few males of the latter are known and the penis valves of these species are rather similar, thus the diagnostic value of the suggested characters (see Fig. 17) needs further study.

The shape of male penis valve is rather uniform in the Nearctic *Equidolerus* species (Fig. 12; see also Goulet 1986), but varies considerably between the Palaearctic members of the subgenus (e.g., Figs 8, 14–16). *Dolerus lucidus* Freymuth, 1870 and *D. purus* Jakowlew, 1891 (male unknown) are not assigned to a subgenus in *Dolerus* s. l. according to Taeger et al. (2010), but their ovipositor structure and postocellar area convincingly place them in *Equidolerus*. Like *D. subfasciatus* and *D. rhodogaster*, *D. lucidus* has also rather different penis valve (Fig. 16) from typical members of the subgenus as well as from the two preceding species. *Dolerus glabratus* Wei, 2002 (male unknown) is transferred from *Equidolerus* to *Dolerus* s. str. on the basis of its ovipositor structure, mesonotum sculpture, and coloration (pro- and mesonotum largely orange), despite its relatively long postocellar area. Thus, at least seven *Equidolerus* species occur in the Palaearctic Region: *D. gessneri* (Holarctic species), *D. lucidus*, *D. pratensis* (Linné, 1758), *D. pseudoanticus*, *D. purus*, *D. rhodogaster*, and *D. subfasciatus*.

A study of the *Equidolerus* species incorporating also DNA characters should help to clarify possible taxonomic issues concerning species which are now regarded common to the western Nearctic and eastern Palaearctic faunas (like *D. gessneri* André, 1880). However, suitably preserved material for such a study is currently available for only a few of taxa. Furthermore, studies of the diverse but much less known fauna of other eastern Palaearctic countries, particularly China and Korea, will most likely uncover some new *Equidolerus* species. A key to the subgenus *Equidolerus* and a revision of its Palaearctic members is in preparation by the first author.

Though host plants of many *Equidolerus* species are still unknown, most of them (if not all) are very likely associated with *Equisetum*.

Species

Taxonomy and distribution of *Dolerus lucidus* and *D. purus*, here regarded as new members of the subgenus *Equidolerus*, will be discussed elsewhere (the specimens studied are from BMNH, SDEI, ZIN, and ZMHB).

Dolerus (*Equidolerus*) *neoaprilis* MacGillivray, 1908, spec. rev.

Table 1; Figs 4, 11–12, 17

Dolerus neoaprilis MacGillivray, 1908: 126. Lectotype female examined. Labelled: "INHS Insect Collection 183,581" [printed], "F. Rauterberg Collection, NEB" [former printed, "NEB" handwritten], "Type of *Dolerus neoaprilis* A. D. MacGillivray, ♀" [printed, red], "*Dolerus neoaprilis* MacG." [handwritten, red frame]; Frison 1927: 242 (lectotype designation).

Dolerus subfasciatus neoaprilis: Benson 1956: 59.

Dolerus subfasciatus auct. non F. Smith, 1874

Distribution. We have examined specimens from the following states and provinces: CANADA: Alberta, Newfoundland, Northwest Territories, Nova Scotia, Ontario, Quebec. USA: Alaska, Colorado, Idaho, Maine, Massachusetts, Michigan, Nebraska, New Hampshire, New York, Virginia. Goulet (1986) recorded this species under the name *D. subfasciatus* from across Canada and northern United States. This species is not Holarctic as has been suggested, e.g., by Benson (1962) and Goulet (1986).

Specimens studied (USNM if not stated otherwise). CANADA: ALBERTA, 20 mi[les]. W. Legal, George Lake, 31.V-3.VI.[19]78, Malaise trap, D.R. Smith [leg.], 1♀; Bilby, 20.VII.1924, O. Bryant [leg.], 1♀, same, 21.VII.1924, 1♀, same 28.VII.1924, 2♀; NEWFOUNDLAND, Cormack, 24.VI.1966, D.R. Smith [leg.], 1♀; 28 mi. NW Deer Lake, 29.VI.[19]'66, D.R.Smith [leg.], 1♀; 3 mi. SE St. George's, 27.VI.1966, 1♀1♂; NORTHWEST TERRITORIES, Norman Wells, 27.V.1953, C.D. Bird [leg.], 1♀1♂, SDEI; Ft. Providence, MacKenzie R., 8.VII.1903, Mack.,1♀; NOVA SCOTIA, 5 mi. E Antigonish, 26.VI.1966, D.R. Smith [leg.], 5♀; ONTARIO, North Bay, 24.VI.1967, NLHKrauss, 1♀; QUEBEC, James Bay Hwy [highway] km 68, 18.VI.[19]85, Sweeping, H.Goulet, D.R. Smith [leg.], 1♀1♂. USA: ALASKA, Anchorage, 30.V.1948, F.S. Blanton [leg.], 1♀; Eklutha, 1.VII.1956, R.L. Washburn, 1♀; Fairbanks, July 2, 1921, J.M. Aldrich coll. 1♀; Matanuska, VI.[19]44, 44-27645Trap, J. Chamberlin [leg.], 1♀1♂; Matanuska, 17.V.1945, rotary trap, J.C.Chamberlin [leg.], 1♀; same data but 5.VI.1945, 1♂; Nenana, 13.VI.1951, R.I. Sailor [leg.], 2♀; Toolik Lake, Alaska Pipeline Rd., Wash. Cr., 21.VI.1978, on Salix, S. MacLean [leg.], 1♀; COLORADO, Garland, 18-6, coll. C.V. Riley, 1♀; Gothic, 9600 ft., 7-1929, M.J. Brown, 1♀; Veta Pass, 1.7, coll. C.V.Riley, 1♀; IOWA, Clermont, 28.VI.1929, A.H. Rolfs [leg.], 1♀; MAINE, Aroostook Co, Littleton, 8.VI.1967, D.R. Smith [leg.], 2♀; Augusta, 1.VI.1946, A.E. Brower [leg.], 2♀1♂; Kennebec Co, Litchfield, 3.VI.1967, D.R. Smith [leg.], 1♀; Oxbow, 6.VI.1941, A.E. Brower [leg.], 1♂; Penobscot Co. Enfield, 7.VI.1967, D.R. Smith [leg.], 4♀; Piscataquis Co, Brownville Junction, 27.V.1966, D.R. Smith [leg.], 1f; Waldo Co, 5 mi N Belfast, 25.V.1966, D.R. Smith [leg.], 1♀; MASSACHUSETTS, Arlington, 28.V.1920, C.S. Sperry [leg.], 1♀; Reading, 10.VI.1919, J.V. Schaffner [leg.], 1♀; Springfield, 4.V.1903, F. Knab, 1♀; Stoneham, 28.V.1932, Blackburn [leg.], 1♀; Watertown, 28.VI.1920, C.S. Sperry [leg.], 1♀; MICHIGAN, Delta Co. 11.VI.1960, R.&K. Dreisbach [leg.], 1♀; NEBRASKA (lectotype); NEW HAMPSHIRE, Coos Co. 10 mi. E Groveton, 18.VI.1983, D.R.Smith [leg.], 1♀; NEW YORK, Franklin Co, 5 mi. E of Tupper Lake, 9.VI.1983, D.R. Smith [leg.], 1♀; Hamilton Co. 5mi. SE Blue Mountain Lake, 5.VI.1983, D.R. Smith [leg.], 1♀1♂; VIRGINIA, Blackburg, 25.IV.1960, S.L. Douthat [leg.], 1♂; Clarke Co, U. Va. Blandy Exp. Farm, 2 mi S. Boyce, 39°05'N, 78°10'W, 28.IV-10.V.1993, Malaise trap, D.R. Smith [leg.], 1♀; Craig Co, Cr. at Rt. 666, Huffman, 1.V.1978, C.M. & O.S. Flint, Jr, 1♀.

Host plant. One larva reared on *Equisetum arvense* from Ottawa and described as that of *D.* (*E.*) *subfasciatus* by Leblanc & Goulet (1992) belongs to this species.

Taxonomic notes. MacGillivray (1908) did not give the number of specimens, but Frison (1927) listed only a single female as "Type". We regard Frison's action as the designation of a lectotype in accordance with Article 74.6 (ICZN 1999). Goulet (1986) found no morphological evidence to distinguish the black Japanese females of *D. subfasciatus* as subspecifically distinct from the Nearctic bicoloured form (*D. neoaprilis*) and synonymized *D. neoaprilis* with *D. subfasciatus* (he likely had no males of the latter species). The species is most similar to *Dolerus pseudoanticus*, and the two can be distinguished with certainty only by ovipositor structure (see Table 1 for separating it from other resembling Palaearctic species). It can be easily distinguished from *D. subfasciatus* by its predominately red abdominal segments 2–6 (in females and males) and tergum 1 bearing almost no punctures and setae (in females).

Dolerus (*Equidolerus*) *pseudoanticus* Malaise, 1931, spec. rev.

Table 1; Figs 5, 13–14, 17

Dolerus pseudoanticus Malaise, 1931: 14–15. Type locality: Klutchi [= Kluchi, Kamchatka, Russia]. Lectotype ♀ **here designated**; right antenna missing, left half of the ovipositor (lance+lancet) glued on paper and pinned with the specimen; NHRS. Labelled: "570" [pink, printed], "KAMTSCHATKA Malaise" [pale, framed, printed], "Typus" [red, framed, printed], "[pale, framed] *Dolerus pseudoanticus* n.sp. (Typus)" [handwritten] Malaise det. [printed]; "[red] *LECTOTYPUS* [printed] ♀ 2012 *DOLERUS PSEUDOANTICUS* MALAISE, 1931 [handwritten] M.Heidemaa des." [printed]; "*Dolerus* (*Equidolerus*) *pseudoanticus* Malaise, 1931 Det. M.Heidemaa" [white, framed, printed]. Paralectotypes: 1♀1♂ from Kamtchatka, NHRS; 1 ovipositor slide, USNM (see taxonomic notes).

Dolerus subfasciatus pseudoanticus: Zhelochovtsev & Zinovjev 1996: 360.

Distribution. This species is known only by the type series from Kluchi in Kamchatka (Russia).

Specimens studied. Part of the syntype series (2♀1♂, see taxonomic notes).

Host plant. Unknown.

Taxonomic notes. A holotype was not designated by Malaise (1931). The syntype series of *D. pseudoanticus* consists of 4♀ and 2♂ according to the original description. 2♀1♂ labelled as type ("Typus", 1♀) and paratypes (1♀ ["Paratypus"], 1♂ ["Allotypus"]) were located at NHRS and studied. A slide preparation of an ovipositor in the USNM, labelled "*Dolerus pseudoanticus*, Paratype [in fact syntype], female saw, Acc. No. 47009" prepared by Ross was also studied and labelled as paralectotype, but the corresponding specimen was not located. The lancet illustrated by Malaise (1931: fig 2.) fits the lectotype and matches also the paralectotypes. This species was synonymized with *D. subfasciatus* by Benson (1962), but the two are distinct according to their ovipositor structure (see also Table 1). Zhelochovtsev & Zinovjev (1996) treated *D. pseudoanticus* as a subspecies of *D. subfasciatus*. A syntype male of *D. pseudoanticus* was studied and is the only known male of this species (another syntype male was not found). It does not allow assessment of any character variation in the species, but its penis valves differ slightly from *D. neoaprilis* (see Fig. 17).

TABLE 1. Imaginal diagnostic characters (ordering independent from their diagnostic value) of *D.* (*E.*) *subfasciatus* and three resembling *Equidolerus* species with abdominal terga 2–6 unsculptured / weakly sculptured but widely reddish. * The number of specimens insufficient to assess character variation.

SPECIES: / CHARACTERS:	***D. subfasciatus*** F. Smith	***D. neoaprilis*** MacGillivray	***D. pseudoanticus*** Malaise *	***D. rhodogaster*** Zhelochovtsev *
POL / OOCL (in females)	0,54…0,64 (n = 5)	0,50…0,63 (n = 5)	0,48…0,49 (n = 2)	0,56 (n = 1)
Clypeus shape	more or less asymmetric	clearly asymmetric	clearly asymmetric	slightly asymmetric
Clypeus emargination	mostly 1/2 of the clypeal length	mostly over 1/2 of the clypeal length	1/2 of the clypeal length	1/2 of the clypeal length
Head behind eyes in dorsal view (females)	subparallel / converging	parallel / subparallel	subparallel	subparallel
Mesepisterna in anterior view	more or less converging ventrally	parallel or diverging ventrally	parallel or converging ventrally	parallel or diverging ventrally
Mesepisternal outline from anterior view	from almost straight to very slightly concave	more or less concave	more or less concave	more or less concave
Mesoscutellar appendage	clearly striate, anterior margin distinctly raised, medial ridge and lateral depressions clear	± striate, anterior margin slightly raised, medial ridge and lateral depressions indistinct	± rugose, anterior margin slightly raised, medial ridge and lateral depressions indistinct	±granulate, anterior margin and the keel indistinct, lateral depressions distinct
Colour of abdominal terga	all black or 3 ± reddish brown	2–6 widely reddish, others black	2–6 widely reddish, others black	2–6 widely reddish, others black
Tergum 1 (in females)	mostly with numerous setae and punctures, microsculpture absent / indistinct	mostly without setae and punctures (sometimes few), microsculpture ±granulate	with some setae and punctures, microsculture indistinct	almost without setae, punctures, and sculpticells
Structure of lancet / ovipositor and median serrulae	Figs 1–2 >10 denticles on median serrulae	Fig. 4 about 10 denticles on median serrulae	Fig. 5 >10 denticles on median serrulae	Fig. 6 <10 denticles on median serrulae
Penis valve	Fig. 8	Fig. 12	Fig. 14	Fig. 15

Dolerus (*Equidolerus*) *rhodogaster* Zhelochovtsev, 1935, stat. nov.

Table 1; Figs 6, 15

Dolerus picinus rhodogaster Zhelochovtsev, 1935: 79–80. Lectotype ♀ **here designated**; antennae incomplete, right half of the ovipositor glued on paper and pinned with the specimen; ZIN. Labelled [transliterated and translated from Russian, date handwritten]: "Mandzhuria [North China] Madiopu pereg. [pass] Taipinlina 26. IV-10.V. 1906. Serebriannikov [leg.]"; "[pale label] *Dolerus picinus* ♀ *rhodogaster* subsp. nov. [handwritten] A. Zhelochovtsev det. 1933 [printed]"; "*picinus rhodogaster* sbsp. n. [pale folded label, handwritten with blue ink]"; "[Red label] *LECTOTYPUS* [printed] ♀ 2012 *DOLERUS PICINUS RHODOGASTER* ZHELOCHOVTSEV, 1935 [handwritten] M.Heidemaa des." [printed]; "*Dolerus* (*Equidolerus*) *rhodogaster* Zhelochovtsev, 1935 Det. M.Heidemaa" [white, framed, printed]. Paralectotypes: 8♀ 1♂, ZMUM.

Dolerus subfasciatus rhodogaster: Zhelochovtsev & Zinovjev 1992: 211.

Distribution. Eastern Palaearctic. China: Manchuria (see data of the lectotype above; Zhelochovtsev 1935). All records from the literature and the paralectotypes need verification as there might be a resembling species (see taxonomic notes below). Russia (Zhelochovtsev 1935): Amur District, Blagoveshchensk (2♀, 9.VI 1931 and 4.VII 1927, V. Verestshagin [leg.]); Budunda (1♀, 29.V 1930, A. Shein [leg.]); Sichote-Alin: Shkotovo (4♀1♂, 3-6.VI 1927, A. Zhelochovtsev [leg.]); Shkotovo, Maiche (1♀, 17.VI 1929. Shablkovski [leg.]); East Siberia (Verzhutskii 1966, under the name *D. subfasciatus* v[ar]. *rhodogaster*): River Malaja Bystraja [Slydyanskij rajon, Irkutskaja oblast] (1♀, 27.VI 1955); Zun-Murino [Tunkinskij ajmak, Buryatia] (1♀, 2.VI 1961); Irkutsk (1♂, no date, V. Jakowlew [leg.]); Tibel´ti [Slydyanskij rajon, Irkutskaja oblast] (2♀, 2.VII and 4.VII 1963); Baikal Region, Tunkinskaja dolina [plain].

Specimens studied. Lectotype ♀, 1♂ (both in ZIN).

Host plant. Unknown.

Taxonomic notes. The lancet of the lectotype female (Fig. 6) fits the fragment illustrated by Zhelochovtsev (1935: fig. 3). The only syntype male mentioned in the original description was not available for study, but we studied one male from the collection of Semenov-Tian-Shansky collected in Irkutsk (Russia) by Jakowlew, which most likely belongs to this species (penis valve in Fig. 15). The colour of the abdomen in this male is not completely black as it was noted by Zhelochovtsev (1935) for the syntype male of *D. picinus rhodogaster* (ZMUM, not examined), but it resembles the lectotype female which has some middle abdominal segments partly red. Also the structural characters mentioned in the description, including the long ventro-apical thorn-like process of the penis valve (not illustrated in Zhelochovtsev 1935) and the structure of the abdominal terga fit this male from Irkutsk (labelled: "*Dolerus picinus* Marl. *subsp. nov*? ♂ A.Zhelochovtsev det. 1933"; its genitalia were not studied by Zhelochovtsev). Paralectotypes: 8♀ 1♂ in ZMUM (3♀ of them were mentioned as paratypes in Zhelochovtsev & Zinovjev 1992 but had in fact syntype status). Large females with extensively red abdominal segments 2–6 (from South Korea, in USNM) and resembling *D. rhodogaster* (identified as *D. subfasciatus* by A. Haris) neither belong to this species nor to *D. neoaprilis*; their identity needs futher study and additional material.

Dolerus (*Equidolerus*) *subfasciatus* F. Smith, 1874

Table 1; Figs 1–3, 7–8, (18–20)

Dolerus subfasciatus F. Smith, 1874: 384. Type locality: Hiogo [= Hyogo, Japan]. Lectotype female examined (designated in Kirby 1882); condition satisfactory (left flagellum, left hind legs and right middle leg partly missing); BMNH. Labelled: "Type H.T." [printed circular pale label with wide red margin], "B.M. TYPE HYM 1.253." [printed square-shaped pale label, the number handwritten], square-shaped pale label: "Hiogo" [= Hyogo, handwritten] "Japan." [printed], "74/6" [circular pale handwritten, date?], "*Dolerus subfasciatus* [Type?] Smith" [pale rectangular handwritten], "Kb. […?]" [pale hand-written, partly unreadable], "*LECTOTYPUS* ♀ *DOLERUS SUBFASCIATUS* F.SMITH DES. IN KIRBY 1882" [red, handwritten in capital letters].

Dolerus picinus Marlatt, 1898: 504. Lectotype ♀ **here designated**; condition poor (mouldy, 4 apical flagellomeres of the left flagellum, left hind leg starting from metafemur and apical tarsomere of the right leg missing); USNM. Labels as in Fig. 18 and "[Red label] *LECTOTYPUS* [printed] ♀ 2012 *DOLERUS PICINUS* MARLATT, 1898 [handwritten in block letters] M.Heidemaa des. [printed]"; "*Dolerus* (*Equidolerus*) *subfasciatus* F. Smith, 1874 Det. M.Heidemaa" [white, framed, printed]; USNM. Paralectotype ♂, labels as in Fig. 19 and "*PARALECTOTYPUS* ♂ … 2012" [… as in lectotype but all handwritten in block letters], "*Dolerus* (*Dolerus*) *japonicus* Kirby, 1882 Det. M.Heidemaa" [white, framed, printed]; USNM (see taxonomic notes).

Distribution. Eastern Palaearctic, at present known only from Japan (Honshu and Shikoku) but may occur in adjacent territories. Material examined is from the following prefectures: HONSHU: Akita, Chiba, Gifu, Gunma, Hyogo, Ibaraki, Ishikawa, Iwate, Kanagawa, Kyoto, Nagano, Nara, Niigata, Osaka, Saitama, Shizuoka, Tochigi, Tokyo, SHIKOKU: Ehime. Some collection records of this species have been published, e.g., by Naito et al. (2004), however, males of this species should be re-examined because *D. japonicus* males have sometimes been misidentified as males of *D. subfasciatus* in collections.

Specimens studied (NSMT if not stated otherwise). JAPAN: HONSHU: Nyuto spa, 800m, Akita Pref., 10.VI.2009, T. Naito [leg.], 1♀1♂; Hachimantai, 1400m, Iwate Pref., 9.VI.2009, T. Naito [leg.], 2♀; Komenoi, Toride-shi, Ibaraki, 8.V.1993, H. Hamaji [leg.], 2♀; Daigo, Ibaraki, 5.IV.2002, A. Shinohara [leg.], 2♂; Ouchi, Bato, Tochigi Pref., 4-5.V.1993, A. & T. Shinohara [leg.], 1♂; same collecting data but 5-7.V.1994, 5♀1♂; same locality 4.V.1996, A. Ta. N. & To. Shinohara [leg.], 1♂; same locality 6.IV.2002, A. Shinohara [leg.], 1♂; Ouchi, Bato, Tochigi Pref. 4-5.V 1993, A.&T. Shinohara [leg.], 1♂, (misidentified as *D. ephippiatus* male by A. Haris); same collecting data, 6.IV 2002, 1♂; Yumoto 1600m, Nikko, Tochigi, 14.VI.1971, A. Shinohara [leg.], 1♀; same collecting data but 5.VI.1977, 1♀; Marunuma, 1420m, Gunma, 3.VI.1971, Ishikawa & Kachi [leg.], 1♀; Tokorozawa, Saitama, 17.V.1931, S. Fujii [leg.], 1♀; Shiki, Saitama, 28.IV.1969, A. Shinohara [leg.], 1♀; same collecting data but 11.IV.1970, 1♂; same collecting data but 24.IV.1970, 1♀; same collecting data but 22.IV.1972, 1♀; Tateyama, Chiba, 15.IV.1931, K. Sato [leg.], 2♀1♂; Chikura, Chiba, 15.IV.1931, K. Sato [leg.], 1♀; Mt.Kiyosumi, Chiba, 16.IV.1931, K. Sato [leg.], 1♂; Kashiwa-city, Chiba pref., 28.III.1971, A. Shinohara [leg.], 2♂; Imperial Palace, Fukiage Gyoen, Tokyo, 16.IV.1997, M. Tomokuni [leg.],2♀1♂; same locality, 07.IV.1999, A. Shimizu [leg.], 3♀; same locality, 07.IV.1999, T. Nambu [leg.], 1♀; same locality, 16.IV.2001, T. Nambu [leg.], 1♀; Kinuta, Tokyo, 10.IV.1959, Y. Kurosawa [leg.], 1♂; Takao, Tokyo,19.IV.1931, S. Asahina [leg.], 1♂; Takaoyama, Tokyo, 6.V.1936, S. Asahina [leg.], 1♀; Mt.Takao-san, Tokyo, 10.IV.1979, T. Niisato [leg.], 1♂; Hikagezawa, Mt.Takao, Tokyo, 19.IV.1973, A. Shinohara [leg.], 1♂; same locality, 17.IV.1977, N. Matsuba [leg.], 2♂; same locality, 24.IV.1977, N. Matsuba [leg.], 1♂; same locality, 24.IV.1994, M. Tomokuni [leg.], 1♀; same locality, 21.IV.1996, A. Shinohara [leg.],1♀; same locality, 19.IV.1998, A. Shinohara [leg.], 1♀; Kamiange, Mt. Jinba, Tokyo, 8.V.1977, A. Shinohara [leg.], 1♀; same collecting data but 17.V.1992, 1♀; same collecting data but 5.V.1997, 1♀; same locality, 30.IV.1977, N. Matsuba [leg.], 1♂; same locality,27.IV.1996, A. & T. Shinohara [leg.], 1♀1♂; Uratakao, Tokyo, 23.III.1967, A. Shinohara [leg.], 1♂; Kariyosezawa, Itsukaichi, Tokyo, 29.IV.1977, A. Shinohara [leg.], 1♀; Tamagawa, Tokyo, 14.IV.1929. H. Sugiura [leg.], 1♀; same locality, 17.IV.1929, S. Fujii [leg.], 1♀; Kobotoke-toge, Tokyo, 23.IV.1967, A. Shinohara [leg.], 1♀; Yokohama, Kanagawa, 11.IV.1930, K. Sato [leg.], 1♂; same collecting data but 20.IV.1930, 1♂; same collecting data but 29.IV.1955, 1♀; same collecting data but 21.IV.1957, 1♀; same locality, 25.IV.1929, S. Fujii [leg.], 1♀; Hiyoshi, Yokohama, Kanagawa, 15.IV.1928, K. Sato [leg.], 2♀; same locality 19.IV.1972, A. Shinohara [leg.], 1♀; Baba-cho, Yokohama, Kanagawa, 22.IV.1955, K. Sato. [leg.], 1♀; Sugita, Yokohama, Kanagawa, 6.IV.1930, K. Sato [leg.], 1♀3♂; same collecting data but 7.IV.1928, 1♂; Gumyoji, Yokohama, Kanagawa, 20.IV.1930, K. Sato [leg.], 2♀; Shinohara-cho, Yokohama, Kanagawa, 23.IV.1955, K. Sato [leg.], 1♀; Chigasaki, Kanagawa Pref., 25.IV.1967, A. Shinohara [leg.], 1♂; Tsukui-ko, Kanagawa, 20.IV.1969, A. Shinohara [leg.], 1♀1♂; Shimogamo-onsen, Shizuoka Pref., 3.IV.1996, A. & T. Shinohara [leg.], 1♀; Shibakawa, Shizuoka, 29.III.1972, A. Shinohara [leg.], 1♂; Sasagamine 1300m, Niigata Pref., 26.V.2009, T. Naito [leg.], 2♀; Niigata Pref. Sasagamine 1300m, 26.V 2009, T. Naito [leg.], 1♀; Mt. Amakazari 1200m, Nagano Pref., 28.V.2008, T. Naito [leg.], 1♀; Yamada, Nagano, 18.V.1932, K. Sato [leg.], 1♀; Nagano, Nagano, 16.V.1932, K. Sato [leg.], 1♀; Gifu, Japan, 5. V [19]18, 1♀, *Dolerus picinus* Marl. ♀ det.Takeuchi, MZAT (coll. R. Forsius); Mt. Uwanai [in Ishikawa Pref.], 1♀, *D. picinus* Marlatt, ZMH (coll. E. Lindqvist); Asakayama-cho, Kameyama-shi, Kyoto., 26.IV.1994, H. Hamaji [leg.], 6♀; Ikuecho, Osaka, 22.III.1928, C. Takeuchi [leg.], 2♀3♂; Nara Park, Nara,17.IV.1929, C. Teranishi [leg.], 1♂; Yoshino, 700m, Nara Pref., 1.V.2008, T. Naito [leg.], 2♀; Mt. Ooginosen, 200m, Hyogo Pref., 8.V.2007, T. Naito [leg.], 1♀; Nishiwaki, 100m, Hyogo Pref., 8.IV.2009, T. Naito [leg.], 2♀; Nishiwaki, Hyogo Pref., 29-IV-1962, R. Inomata [leg.], 1♀, SDEI; same collecting data but 12-IV-1960, 1♂, SDEI; same collecting data but 8.IV 2009, 2♀; Hyogo Pref., Mt. Hinakura 1000m, 6.V 2008 T. Naito [leg.], 1♀. SHIKOKU, Nanokawagoe, 1450m, Ishizuchi-yama Mts., Ehime Pref., 9.V.2005, A. Shinohara [leg.], 1♂.

Host plant. Okutani (1967) recorded *Equisetum arvense* as a host of this species (under the erroneous name "*D. umbraticus* Marlatt, 1898" (currently a synonym of *D. ephippiatus* F. Smith, 1874 [a species associated with *Poodolerus*]), see Okutani 1970, for a correction of the name.

Taxonomic notes. The number of female syntypes of *Dolerus subfasciatus* was not specified in the original description but the statement "a. ♀. (Type.) Hiogo [= Hyogo, Japan]. G. Lewis, Esq. [= Esquier?]" in Kirby (1882), referring to one certain syntype female, is a valid lectotype designation in accordance with Article 74.6 (ICZN 1999). This is the only female with such label data in the BMNH.

Equidolerus species which include specimens with a black abdomen (e.g., *D. gessneri*) and some other species with a partially red abdomen (e.g., the Nearctic *D.* (*E.*) *frisoni* Ross, 1931), also differ from *D. subfasciatus* by their distinctly striated (with keel-like sculpticells), largely matt terga.

Dolerus picinus was correctly regarded as a synonym of *D. subfasciatus* by Benson (1956). Benson (1962) mistakenly synonymized *D. picinus rhodogaster* and *D. pseudoanticus* with *D. subfasciatus* (the male of the latter species was not known to him, but he did examine the male of *D. neoaprilis*). The original description of *D. picinus* was based on a syntype series of 6♀ and 4♂ from "Gifu and zuzushi", Japan (Marlatt 1898). The original collection labels of the available syntypes (Figs 18–19), which were given to the USNM by Dr. K. Mitsukuri of Imperial University, Tokyo, Japan as a present, were handwritten by a Japanese collector and could read "Gifu, Tsutsumi" not "Gifu and zuzushi" as given by Marlatt (1898). "Gifu" indicates the name of a locality, but "Zuzushi" (spelled in Marlatt 1898 also "Gifu zuzushi" in case of some other species) is a strange and inexplicable word. Probably this is not a locality name, but corresponds with "tsutsumi" which is a common word for a river bank, a likely habitat for some *Dolerus* species. Marlatt did not designate a holotype. Only one female and one male of the type series were found in USNM. All should have the red type labels "[sex] Type 3837 U.S.N.M". The two syntypes of *D. picinus* belong to *D. japonicus* (paralectotype male) and *D. subfasciatus* (lectotype female). The genital capsule without penis valves is stored inside a microvial pinned with the specimen. Because the microscope slide with penis valves of the paralectotype was not found, the male genitalia of a conspecific male (belonging also to *D. japonicus* and misidentified as *D. picinus* by S.A. Rohwer; now in MZAT) with identical locality label in Japanese (Fig. 20) as in the paralectotype male (Fig. 19) are illustrated (Figs 9–10). It cannot be excluded that the male in MZAT which is identical with the misidentified paralectotype of *D. picinus* bearing the same locality label, is one of the missing syntypes of *D. picinus*. This misidentified male and one correctly identified female of *D. japonicus* (both now in MZAT), all bearing identification labels written by Rohwer (Fig. 20) and the locality labels in Japanese (Figs 18–20), match the specimens presented by K. Mitsukuri to C. L. Marlatt for determination (see Marlatt 1898 for details). The males of *D. japonicus* were certainly mistaken as *D. picinus* (= *D. subfasciatus*) by Marlatt and Rohwer, and the males of *D. neoaprilis* as *D. subfasciatus* by most authors.

We found also that the syntype male of *D. yokohamensis* Rohwer ("Allotype No 27302 U.S.N.M.", [red printed label], "*Dolerus yokohamensis* allotype ♂ Roh.", [white handwritten label with black printed frame]) is a misidentified male of *D. subfasciatus*. Because Rohwer's type series of *D. yokohamensis* is a mixed series, and he did not designate a holotype in the original description ("1♀1♂"), we **here designate** the female as lectotype so that the species names will be applied correctly in the future. The lectotype (USNM) is labelled: "No. 3", "Yokohama, Japan, Apr. 14-24", "S. I. Kuwana coll. ", "Type No. 27302, U.S.N.M.", "*Dolerus yokohamensis* Roh., TYPE ♀".

Though the penis valve of *D. subfasciatus* was apparently first sketched by Haris (2001), most likely based on a specimen from NSMT, the male of this species has been known to Japanese sawfly taxonomists for a long time (e.g., a male in SDEI from Nishiwaki identified by T. Naito, see above). Togashi (1962, 2000) also recorded males of this species, but the male recorded by Togashi (2000) was collected in October, suggesting a possible misidentification for *D. japonicus*.

Despite their very different penis valves, *D. subfasciatus* (Fig. 8) and *D. japonicus* (Fig. 10) often are found mixed in collections, possibly because of their similar habitus and colour pattern. The male of *D. subfasciatus* also can be separated from *D. japonicus* by the clypeal emargination at least half the length of the clypeus (clearly less than half of the clypeus length in *D. japonicus*), abdominal terga with distinct sculpture, and by the colour of tergum 3, which normally has at least some traces of reddish brown (black in *D. japonicus* males). The Japanese name of *Dolerus japonicus* is "*Osu-guro-habachi*" meaning that the male is black (Nakagawa 1902, Harukawa & Kumashiro 1930). Togashi (1970) described the male internal reproductive organs of *D. picinus*, but the specimens used should be verified whether they belong to *D. subfasciatus* and not to some misidentified male of *D. japonicus*.

Description of male

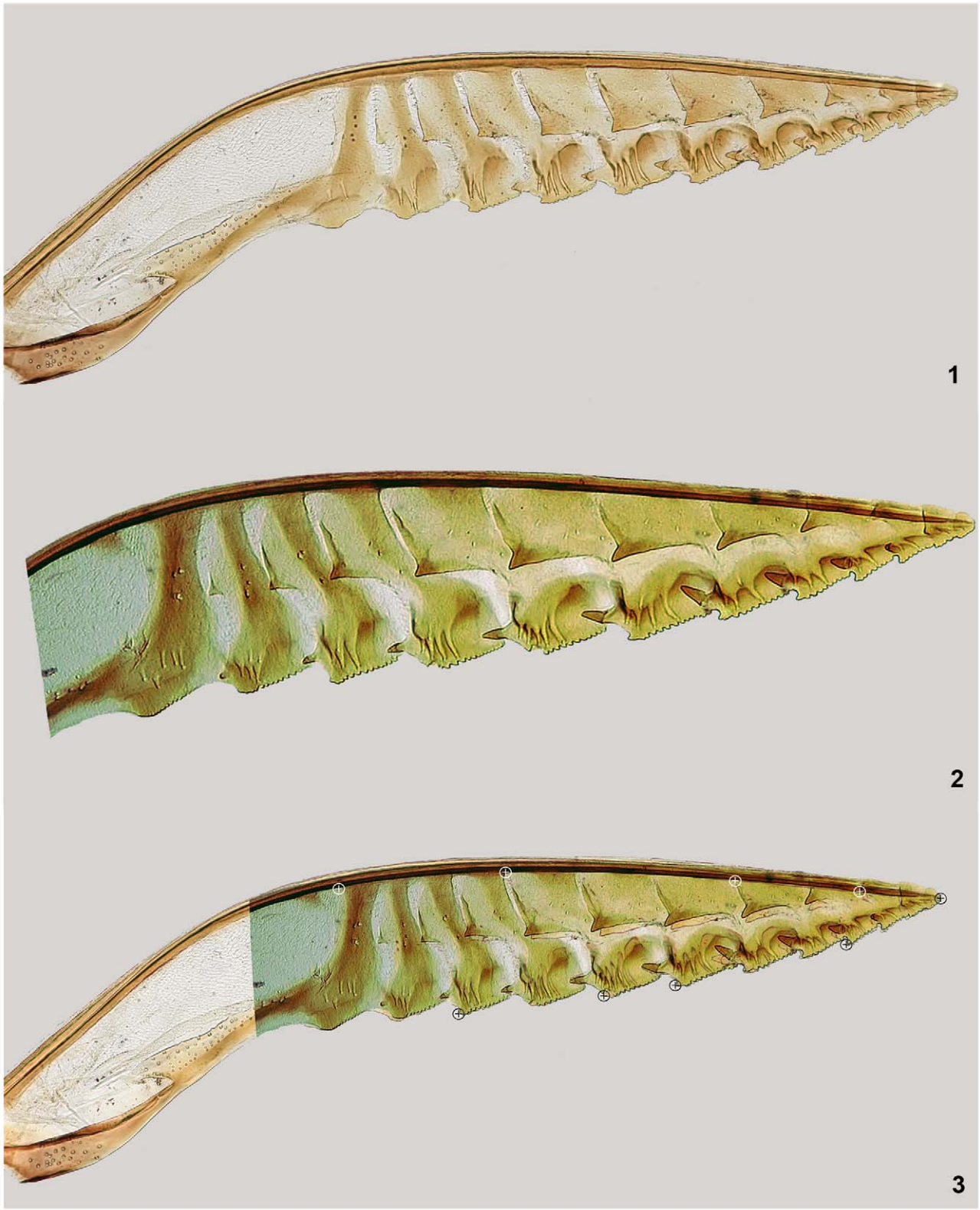
Colour. Black; tergum 3 varying from black to red brown, sometimes also posterior part of tergum 2 and anterior part of tergum 4 similarly coloured; terga usually with narrow pale posterior margin (can be interrupted) starting from tergum 2; apex of fore femur, at least inner side of fore tibia, and tarsomeres including pulvilli and tarsal claws more or less yellow brown, at least base of protarsomeres and metatarsomere 1, and apical spurs all more or less yellow brown; sometimes also middle and hind legs similarly coloured, but usually darker; wing venation partly brownish, at least in proximal part. Setae silvery, somewhat brownish on scape and pedicel, black on flagellomeres.

Head. Postocular area converging behind eyes in dorsal view. Postocellar area rectangular or slightly trapeziform, POL / OOCL ratio 0.71–0.77 (n = 5), convex, punctures partly fused, medial punctures mostly separated by glossy or slightly sculptured interspaces, sometimes wider than diameter of largest puncture; lateral postocellar furrows distinct and deep. Postocular area mostly convex, macro- and microsculpture as on postocellar area, but interspaces between punctures often larger, forming somewhat glossy band (sometimes raised) reaching from eye to occipital carina; vertex more or less concave with mostly fused and irregular punctures. Malar space ca 1.5 times as long as diameter of ocellus, ca 0.5 times as long as distance between antennal toruli. Clypeus more or less asymmetric, right lobe more prominent, medially with transverse raised ridge, Clypeal emargination ca 0.5 times as deep as median length of clypeus (in some specimens shallower or deeper). Antenna about as long as the distance from tegula to apex of pterostigma. Length (minimum and maximum, in mm; n = 5) of flagellomeres 1–7 as follows: 0.90–0.97, 0.90–0.97, 0.83–0.90, 0.69–0.78, 0.64–0.70, 0.58–0.66, 0.50–0.64.

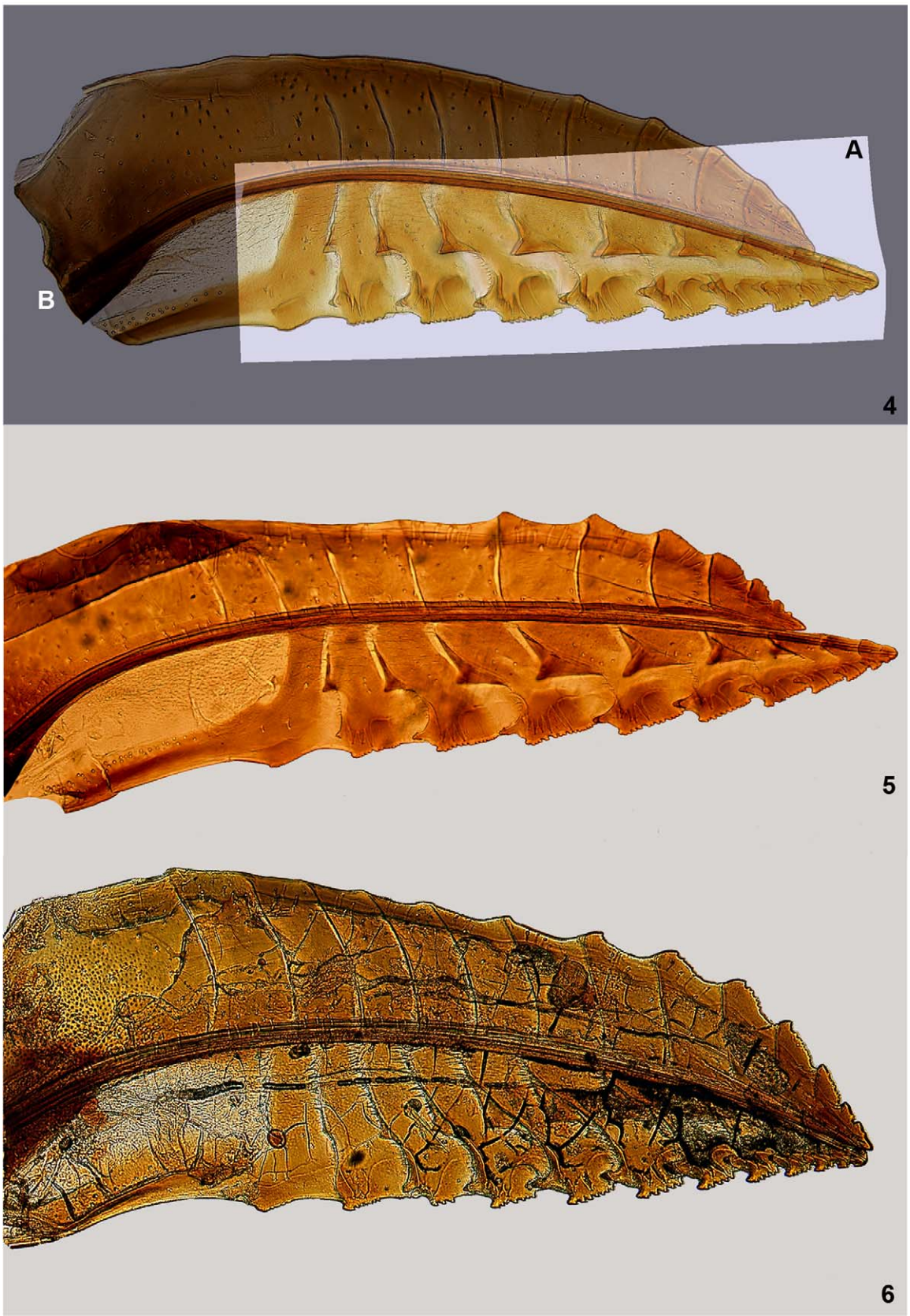
Thorax. Mesepisternum with longest setae at least 1.7 times of ocellar diameter, punctures variable in size and shape from minute, nearly circular, to polygonal with size up to that of ocellus. Mesoscutellar appendage clearly striate with anterior margin distinctly raised, medial ridge and lateral depressions clear. Lateral mesoscutal lobes in upper portion more sparsely punctured than median lobes and mesoscutellum, interspaces without distinct microsculpture, glossy. Lower part of posterolateral portion of mesoscutum with transverse and ridge-like sculpticells, upper part punctured, interspaces glossy. Katepimeron mostly with worm-like (sometimes almost bead-like) sculpticells on anterior half. Upper part of metepisternum with irregular partially fused punctures, gradually fading toward glossy ventral part. Metepimeron more or less convex with variable sculpture, at least partially glossy.

Abdomen. Tergum 1 largely glossy (microsculpture absent or indistinct), at least with some punctures and setae (usually numerous) in median part. Tergum 2 with less evident sculpture and less setae, usually shorter than on tergum 1 but longer than on terga 3–8, sometimes almost glossy and without setae; sculpticells mostly scale-like and / or ridge-like. More or less triangular glossy regions without setae and sculpticells usually visible on central parts of terga (5)6–8. Genitalia as in Figs 7–8.

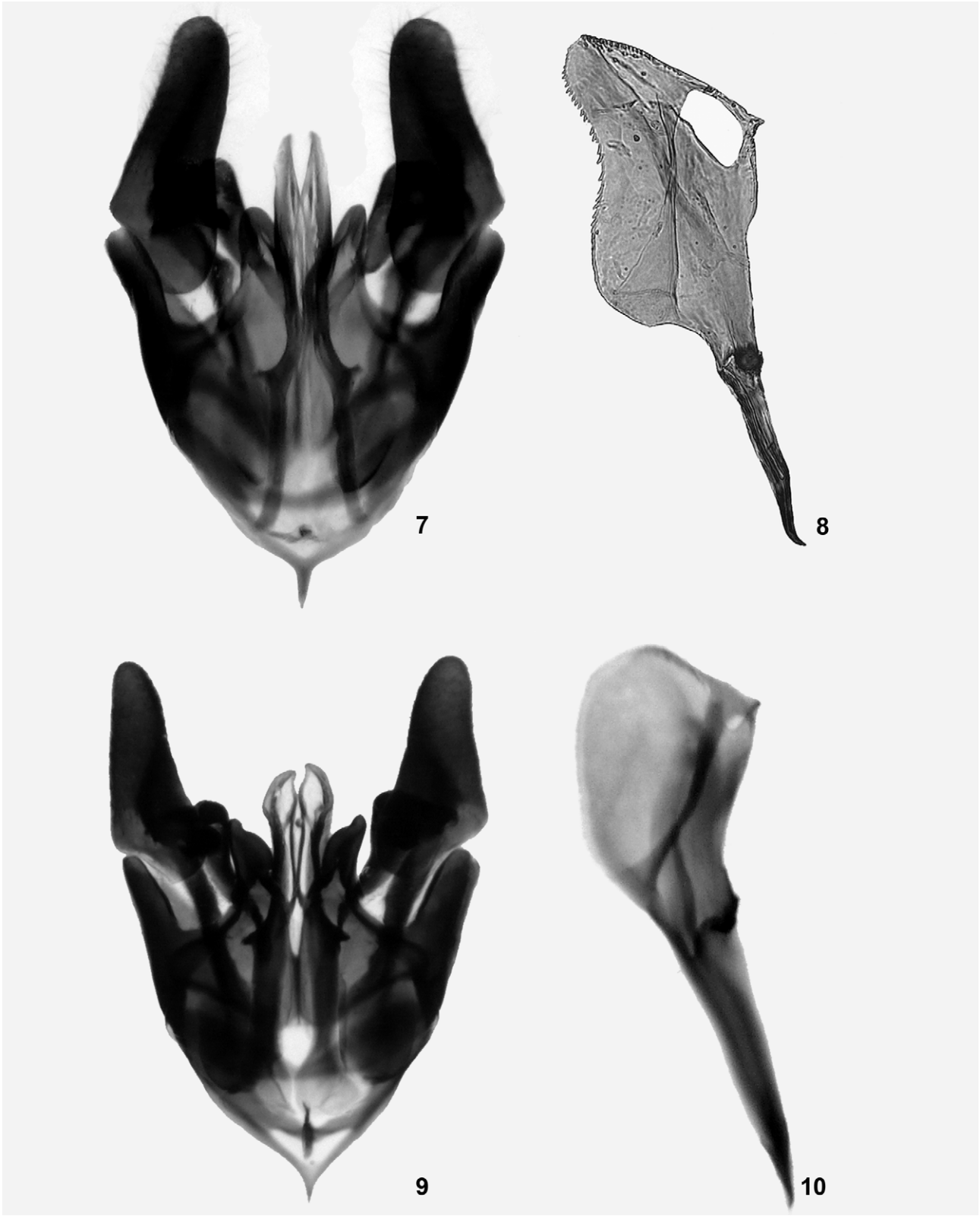
Taxonomic affinities. Compared to the species with predominantly red abdomen, the male has abdomen black or with only some fading traces of a reddish pattern on tergum 3. The penis valve (Fig. 8) is rather different from other *Equidolerus* species (Figs 12, 14, 15–16) and from *D.* (*D.*) *japonicus* (Fig. 10), resembling some members of *Dolerus* s. str. and *Poodolerus* species.



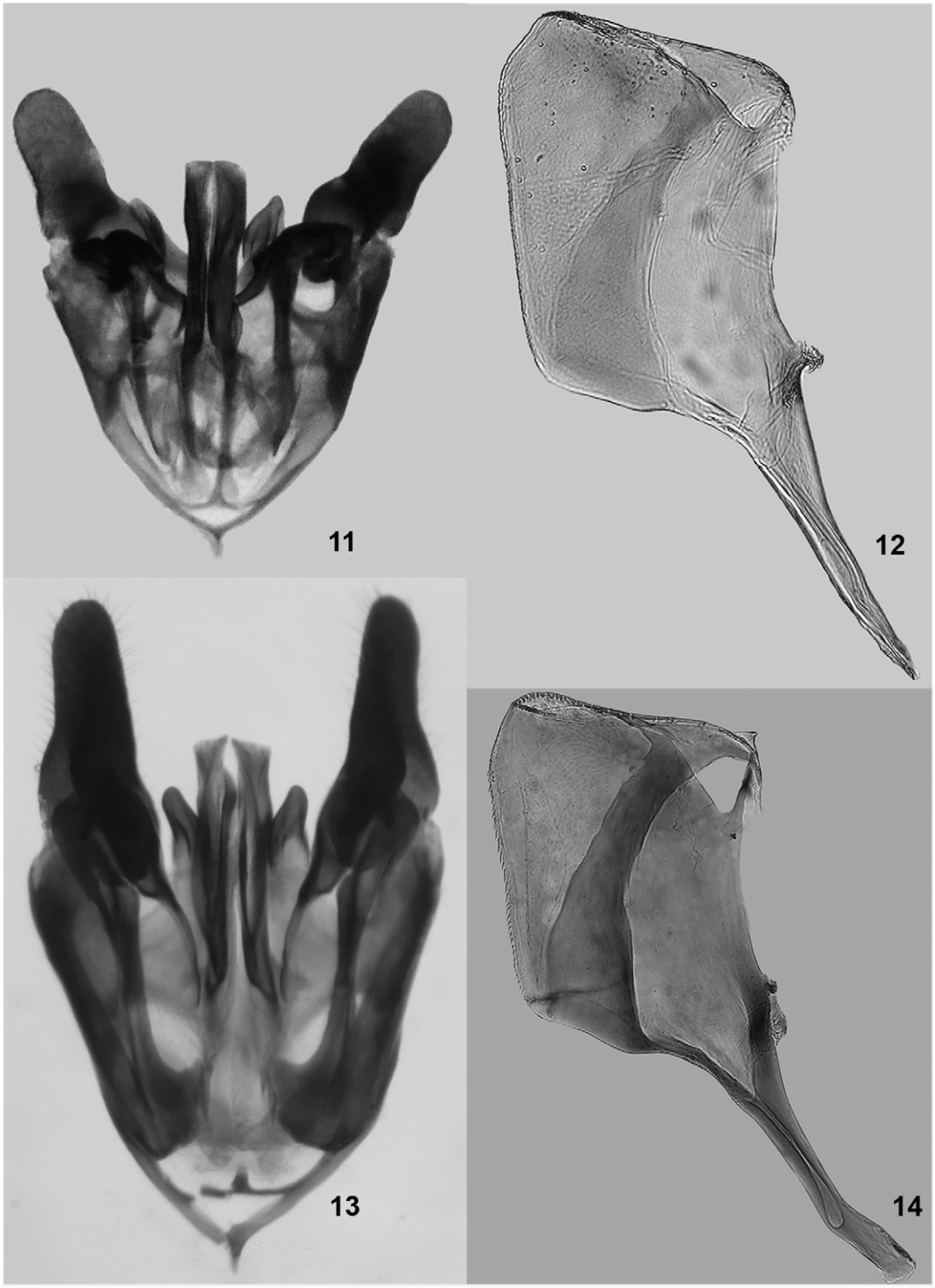
FIGURES 1–3. Lancets (valvulae 1) of lectotype females: 1, *D.* (*E.*) *subfasciatus* (photo used with permission of BMNH); 2, *D. picinus* (= *D. subfasciatus*). 3, Digital overlay of the ovipositor images of lectotypes (Figs 1–2) for their visual comparison (nine encircled crosses correspond to landmarks).



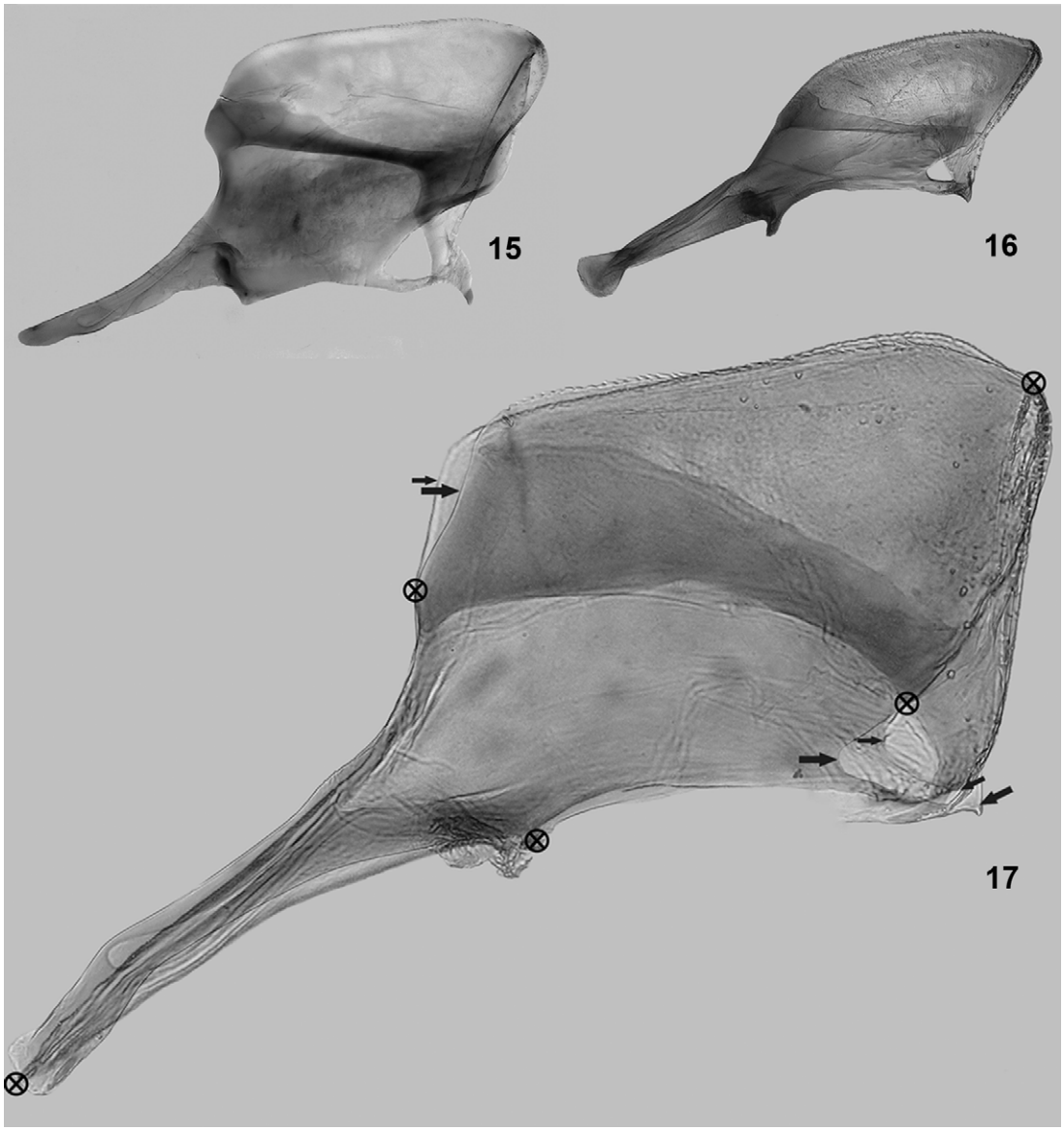
FIGURES 4–6. Ovipositors / lancet: 4, digital image overlay of *D.* (*E.*) *neoaprilis* lectotype lancet (A) and ovipositor (B) of conspecific non-type specimen (same set of landmarks used as in Fig. 3); 5, *D.* (*E.*) *pseudoanticus*, ovipositor (paralectotype); 6, *D.* (*E.*) *rhodogaster*, ovipositor (lectotype of *D. picinus rhodogaster*).



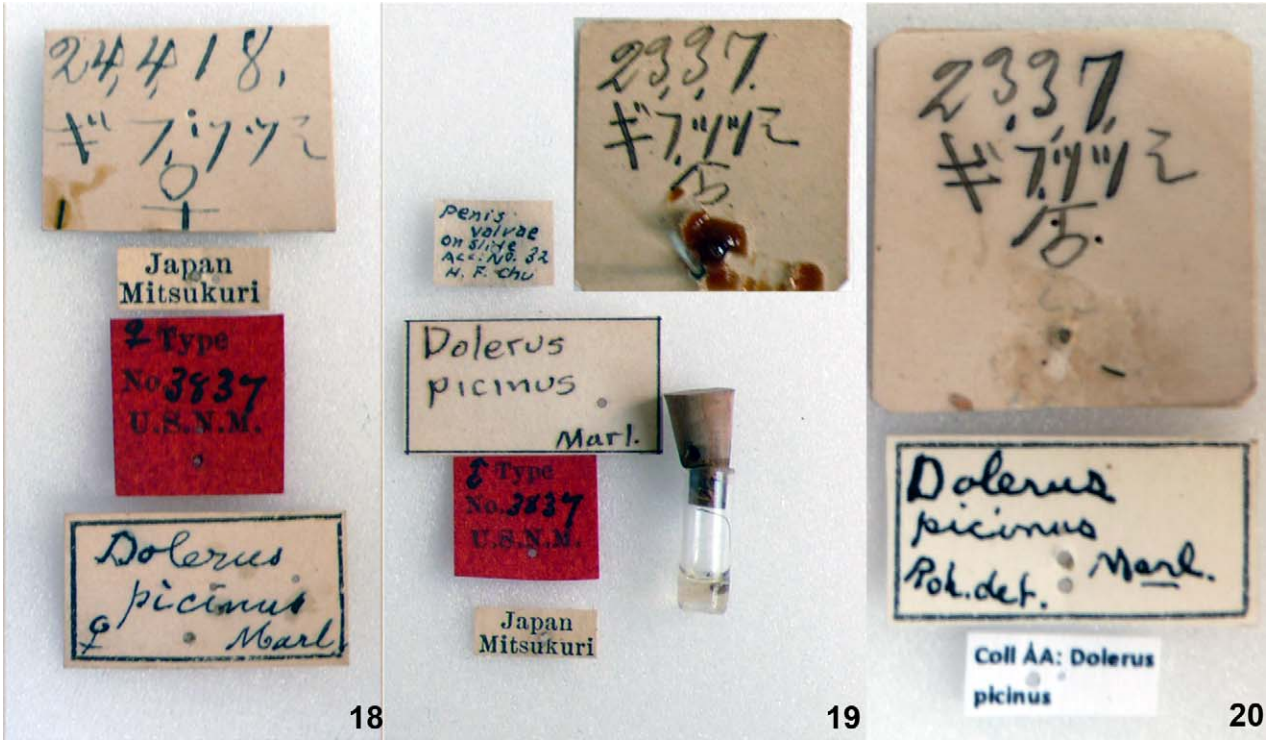
FIGURES 7–10. Male genitalia: 7, *D.* (*E.*) *subfasciatus* (= *D. picinus*, NSMT): genital capsule in dorsal view; 8, right penis valve in lateral outer aspect; *D.* (*D.*) *japonicus*: 9, genital capsule in dorsal view (specimen from MZAT, see taxonomic notes for additional information); 10, right penis valve in lateral outer aspect.



FIGURES 11–14. Male genitalia: *D.* (*E.*) *neoaprilis* (= *D. subfasciatus* auct. non F. Smith, USNM): 11, genital capsule in dorsal view; 12, right penis valve in lateral outer aspect; *D.* (*E.*) *pseudoanticus* (paralectotype): 13, genital capsule in dorsal view; 14, right penis valve in lateral outer aspect.



FIGURES 15–17. Penis valves (right valves, lateral outer aspect): 15, *D.* (*E.*) *rhodogaster* (non-type, ZIN); 16, *D.* (*E.*) *lucidus* (non-type, BMNH); 17, *D.* (*E.*) *neoaprilis* (non-type, USNM) and *D.* (*E.*) *pseudoanticus* (paralectotype): digital image overlay using landmarks (five encircled crosses correspond to landmarks and black arrows indicate structural details differentiable between *D. neoaprilis* [smaller arrows] and *D. pseudoanticus* [larger arrows]).



FIGURES 18–20. Labels from types / essential specimens (see taxonomic notes under *D. subfasciatus* for details): 18, *D. picinus* lectotype female; 19, *D. picinus* paralectotype male; 20, *D. picinus* male (possible syntype, MZAT).

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